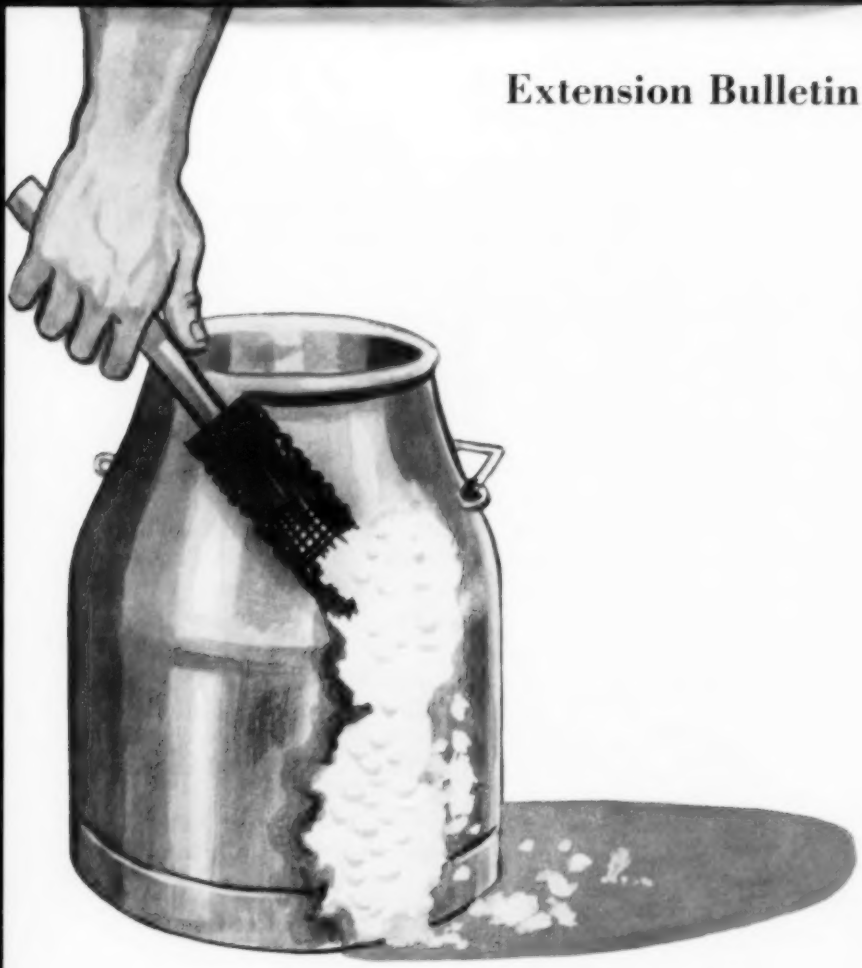
Extension Bulletin 941



The Sanitary Care of . . .

Milking Equipment

on the Farm

F. V. Kosikowski and R. F. Holland

The Sanitary Care of Milking Equipment on the Farm

F. V. Kosikowski and R. F. Holland

Milking equipment on the farm is relatively easy to keep clean. Improved design, better rubber, and seamless stainless-steel parts, along with the development of new washing and sanitizing compounds and the accumulation of information for their proper application, all contribute to cleanliness.

Despite these significant advances, many milking machines and much equipment are not clean. A failure to take time to perform the proper cleaning chores and a lack of information on the part of some milk producers are basic reasons. This should not be tolerated, as dirty milking equipment is one of the chief sources of high bacterial counts in milk.

In addition to standard milking-machine equipment, pails, and strainers on the farm, the introduction of "cleaned-in-place pipelines" and farm tank coolers present the producer with new problems in cleaning and sterilizing. The purpose of this bulletin is to outline acceptable methods for the sanitary care of all milking equipment on the farm and to discuss some of the measures that lead to a good-quality milk. Although illustrations here deal mainly with long-tube milking machines, basic principles and instructions apply equally well to short-tube milking machines.

Authors' Acknowledgment. The research on the cleaning of pipeline milkers was supported with funds contributed by the Tri-Clover Division of the Ladish Company, Kenosha, Wisconsin.

Milking Machines and Miscellaneous Equipment

Washing

Treatment of assembled machine just before milking

On most dairy farms the milking units are fully assembled about 30 minutes before use. Practically all farmers rinse the machines with hot water (180°F.) or chlorinated water to check bacterial growth.

If you use chlorine, fill a 12-quart pail with clean lukewarm water and add enough chlorine to make a 200 p.p.m. solution. Connect the air hose to the stallcock in the washroom and, with the vacuum on, immerse the teat cups in the chlorine solution. After rinsing is complete, empty the milking pail, allow the

Figure 1. Preparing the rinse water and the washing powder solution in the washroom just before milking is completed

teat cups to drain momentarily, and replace the milking head.

Care of machines during milking

Excess organic material decreases the efficiency of sanitizing. Dropping the teat cups or turning over the milking pails during milking operations tends quickly to create a messy looking piece of equipment, especially if the stable or cow is not clean. This condition can be prevented by being careful about placing the milking machines on the cows and about handling the machines between cows. Sometimes a low vacuum in the system may allow teat cups to slip to the barn floor.

First rinse of machine and equipment after milking

To rinse without delay after milking is a key point in successful cleaning. Have the rinsing and washing solutions ready in the washroom shortly before the last cow is milked (figure 1). Bring the milking units and miscellaneous utensils to the washroom for quick rinsing immediately after milking.

Fill a 12-quart pail or container with clean lukewarm (100°F.) water for each milking unit. Connect the milking machine to the stallcock and suck all the clean rinse water through the machine with air brushing (figure 2). Air brushing means to move the teat cups momentarily in and out of the rinse water several times to provide more agitation throughout the teat cups.

Figure 2. Rinsing the teat cups with clear lukewarm water after milking
Note the air-brush action

Figure 3. Emptying the rinse water down the drain

Increased agitation causes a better scrubbing action on the internal surfaces and removes more milk film.

When all the rinse water from the pail has entered the milking unit, rock the machine five or six times from side to side for better distribution of the water. Remove the head and empty the rinse water down the drain (figure 3). Replace the head in preparation for the next step.

Hand washing

Hand washing is the proper application of a washing-powder solution accompanied by vigorous brushing. A two-compartment sink in the milkhouse is essential for this operation, and a three-compartment sink is preferable.

Pull into the machine from another pail without air brushing approximately 2 gallons of relatively hot water (135°F.) containing washing powder. [1] Then shut off the vacuum and splash the contents of the milking pail by rocking five or six times. This action further aids in cleaning the interior. Remove the machine head. With a good bristle brush, scrub the rubber and metal surfaces with the solution in the milking pail (figure 4).

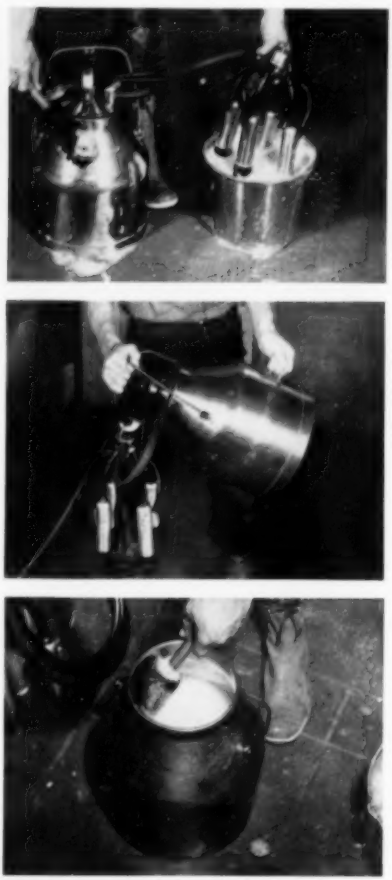


Figure 4. Washing the milking machine
From top to bottom: Sucking wash water through the machine and brushing outside surfaces; shaking machine to get better washing; brushing inside of pail after removing head.

[1] Add 1 full tablespoon (1 ounce) of a good washing powder to 2 gallons of hot water.

Separate the complete teat cup assembly from the head, and set it aside temporarily in a clean dry place. Empty the wash solution from the milking pail into the first compartment of the sink (figure 5). Place pail, head, and miscellaneous equipment in the wash-water compartment and complete washing with the brush. After every milking, remove the rubber gasket on the head, remove the moisture trap and its gasket (figure 6), and thoroughly clean all, including the head, in the sink. Remove the pulsator from the machine and store it in a safe, dry place.

The rubber teat-cup assembly may be left intact for subsequent sterilization. Some producers, however, remove the teat cups from the claw and wash them thoroughly with appropriate sized brushes at least once a day and preferably after the morning's milking (figure 7). This is a partial and not a complete disassembly.

Give all miscellaneous milking equipment, including pails and strainers, the same wash treatment. After you have washed the milking machine and all accessories in the first compartment of the sink, thor-

Figure 5. Emptying the wash water into the sink.

This water can be used again for washing parts of the machine and miscellaneous equipment in the sink.

Figure 6. Milking machine head and its disassembled parts

These parts are washed after each milking.

oughly rinse them in the second sink compartment with clean cold or lukewarm water (figure 8).

Figure 7. Specially designed brushes are needed for the major parts

From top to bottom: brushing milk hose after washing, a metal burr on rod is preferable to brush; brushing teat cup; brushing claw.

Figure 8. Milking machine in rinse water compartment after washing

Sterilizing

Several excellent methods for sterilizing milking equipment are available. Your choice of these methods is determined by local or state health regulations, by local farm conditions, and by advantages inherent in each of the sterilizing agents. Three common methods of sterilization are presented here.

Chemicals and dry storage

The use of a chemical and dry storage can be the cheapest and, under proper conditions, a satisfactorily efficient method of sterilizing.

After you have completely rinsed the milking machine in the second compartment sink, reassemble it. Fill a 12-quart pail almost full with 200 p.p.m. chlorine solution [2]. Attach the machine to the stallcock in the washroom and turn on the vacuum.

[2] Second sink compartment may contain a 200 p.p.m. chlorine rinse thus eliminating the need for further rinsing.

Pull all the chlorine solution through the machine with some rocking. Stop the vacuum and empty the pail of chlorine solution after 3 minutes.

Remove the teat-cup assembly as a complete unit and hang it in a clean, dry place until the next milking (figure 9). Place the metal parts of the machine on a clean rack. If a steam cabinet or an electric oven is available, store the metal parts of the machine in it for more effective sterilization (figure 10). Minimum heating in a steam cabinet should be at 170°F. for 15 minutes; in an electric oven, at 180°F. for 20 minutes. Hang the gasket from the head on a dry peg in the washroom.

Figure 9. Teat-cup assembly hanging in a clean, dry place.

Figure 10. Interior of electric oven sterilizer

Note the neat arrangement of machine parts for quick assembly.

All additional metal milking equipment, including pails and strainers, can be placed in dry storage, in a steam cabinet, or in an electric oven for sterilization as for milking-machine parts.

Chemicals and wet storage

The use of a chemical and wet storage is slightly more expensive but is a more efficient sterilizer of rubber parts than is the dry-storage method.

Treat the milking machine and miscellaneous parts the same as in the dry-storage method but fill the teat-cup assembly, after rinsing with chlorine solution, with a liquid sterilizer such as lye, chlorine, or quaternary ammonium compound until the next milking.

Attach the freshly rinsed teat-cup

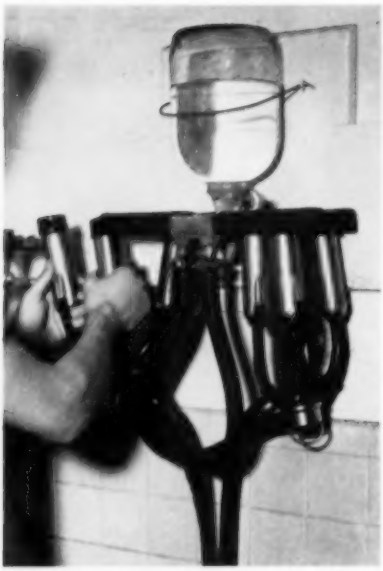


Figure 11. Placing teat-cup assembly in lye racks for sterilization

assembly by the rubber milk line to the spigot on the lye rack [3] (figure 11). Open the spigot and allow 0.4 per cent lye solution to travel to the very top of the teat-cup liners.

Substitute a 200 p.p.m. chlorine solution for the lye in the rack, if desired, but always use brown bottles to prevent light from weakening the chlorine solution.

Quaternary ammonium solutions have been suggested as a replacement for lye or chlorine at this point, but recent studies at Cornell [4] indicate that quaternary ammonium solutions alone show considerably less effectiveness against certain bacteria, such as Pseudomonas, than does lye.

Hot water and dry or wet storage

For successful results, the hot water and dry- or wet-storage method depends upon adequate quantities of hot (190°F.) water in the washroom (figure 12). If enough water is not available and the temperature is considerably lower than recommended, it is advisable to use one of the other two sterilizing steps. Used properly, this hot-water method is highly efficient and inexpensive.

After proper washing, rinse each milking machine (figure 13) with one pail of hot water (190°F.) and soak all accompanying parts for 3 minutes in a sink compartment containing water at the same temperature. Place the teat-cup assembly in wet storage in lye or chlorine or in dry storage.

In-Place Cleaning of Pipeline Milkers

THE installation of permanent pipelines in dairy plants has led to the expansion of this labor-saving system to many dairy farms. Dairy farm operators are expressing keen

[3] *Milking Machines — Washing and Care*, by H. J. Brueckner and H. S. Pringle. Cornell Extension Bulletin 519. 1942.

[4] *The Sanitizing of Milking Machines*, by A. C. Dahlberg, F. V. Kosikowski, H. W. Seeley, and A. A. Leventhal. Jour. Milk and Food Tech., vol. 13, No. 1, 1950.

Photo from DeLaval

Figure 12. An electric hot-water heater
Water temperature must be at least 180°F. for effective sterilization.

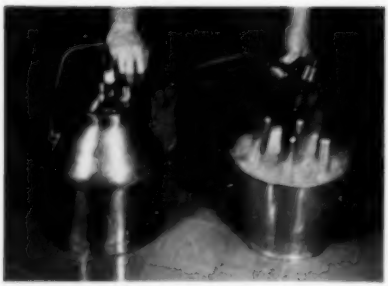
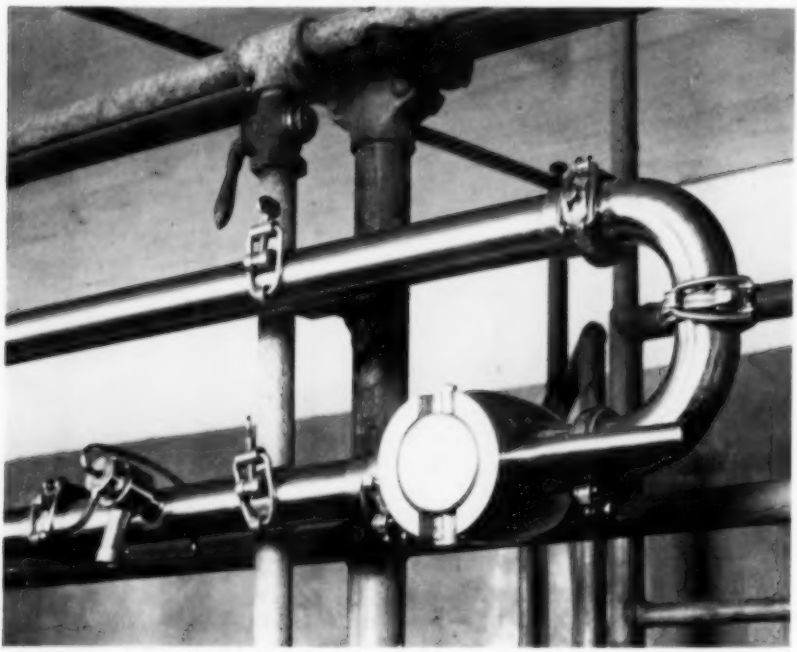


Figure 13. Sterilizing machine with hot water

interest in the pipeline milker, and the number of installations is increasing rapidly. Two types of installations are common. The milking parlor type, generally used with a pen stable, and the around-the-barn type which is used in stanchion barns. Although the cost of the around-the-barn pipeline milker is high, relative to that of the conventional milking machine, the reduction in the labor time used in transferring the milk from the barn to the milkhouse, the elimination of the milker pail and transfer pail, and the simplicity of the cleaning operation have encouraged farmers to make the necessary investments.

A close-up of a pipeline milker installation in a milking parlor using the double-pipe system for recirculatory cleaning is shown in figure 14.

Figure 14. Pipeline milker installation showing pipe anchor clamp, permanent union, stallcock, and sanitary valve



The clamp for anchoring the pipeline in place, a permanent union, a stallcock, and a sanitary valve are shown.

State health authorities have set up certain minimum specifications for pipeline milker installations.

Water supply

Running hot and cold water are an essential part of all installations of pipeline milkers planned to be cleaned in place. In the milking parlor, both hot and cold water should be available near each milkcock.

The supply of running hot water should be at least 50 per cent more than the actual quantity necessary for cleaning and sanitizing the system according to recommended procedures.

Design

Cleaned-in-place pipeline milkers shall:

(1.) Include no avoidable dead end.

(2.) Be installed with adequate slope for drainage. This requirement can be interpreted to mean about 1 inch of slope for 20 feet of pipeline.

(3.) Be installed without sags in which water can accumulate.

(4.) Have pipelines firmly anchored in place.

Plastic pipe or fittings are not recommended for installations planned to be cleaned in place.

Rubber-sleeve connectors are not recommended, and, if used, shall be removed daily and brushed clean.

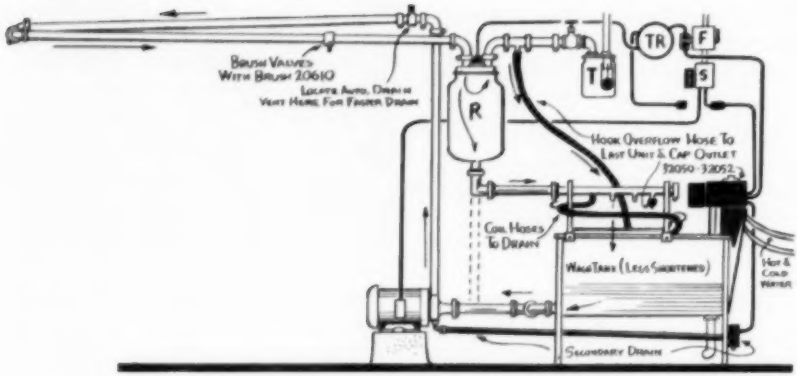
Cleaning procedure

The cleaning of permanent pipelines involves the same fundamental procedures as those that are recognized as essential for the manual cleaning of dairy equipment. These fundamentals are: the clean water rinse, the cleaning-solution wash, and sanitizing.

Pipeline milker systems are generally installed to be cleaned either by the recirculatory method (figures 15 and 17) that requires double piping or a continuous line around the barn or milking parlor, by the reverse flush method (figure 16) in which the cleaning solutions flow in alternate directions at intervals controlled by some automatic device, or by the flush system in which the solutions are simply drawn through the stallcock and discharged to a drain or to a receptacle such as a sink or a milk can.

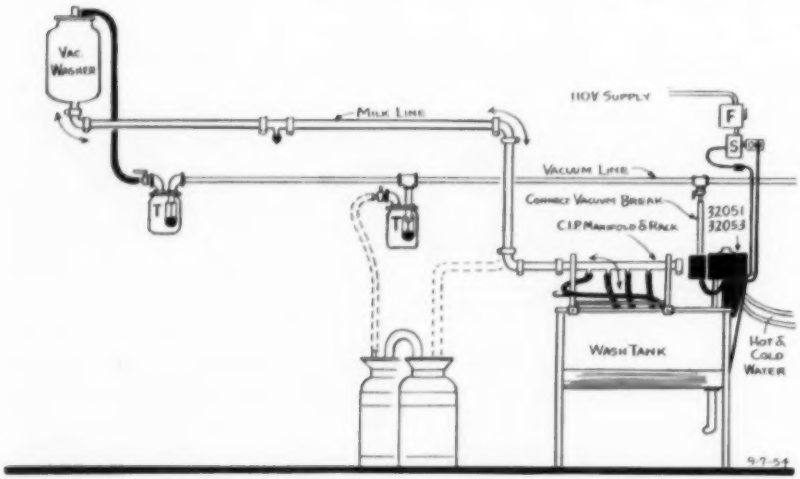
Rinse

Regardless of which cleaning system you use, the first rinse is probably the most important part of the cleaning procedure. As soon as the last milk has flowed through the line, flush the line with cold or lukewarm water until the water flows clear. This rinse water should not be recirculated but should be discharged to the drain. If properly done, the rinse removes practically all of the milk residues in the system. Flush clean with the hose or in the sink all parts not touched by the flowing rinse.



Drawing from the De Laval Separator Co

Figure 15. Diagram of an arrangement for the recirculatory system of cleaning pipeline milkers



Drawing from the De Laval Separator Co.

Figure 16. An arrangement for the reverse flush system of pipeline cleaning.

Washing

Because of the great differences in farm water supplies, it is economically impossible to make blanket recommendations as to washing powders and washing solutions that are adequate for all situations. The best that can be done is to obtain washing powders manufactured by a reputable cleaner manufacturer, tailored to the farm water supply, and designed for in-place cleaning

of pipeline milkers. The manufacturer's directions as to concentration, temperature of solution, and time of application should be carefully followed. Cleaners of the alkaline type are generally most economical and effective. Again depending upon the characteristics of the water supply, it may be necessary to substitute an acid milkstone remover for the alkaline solution once or twice a week.

Quaternary ammonium cleaner sanitizers are generally not recommended for the cleaning of permanent pipeline installations.

If you clean the system by the flush procedure, the State Department of Health recommends "washing of the entire system after rinsing with not less than 20 quarts of a suitable detergent solution prepared according to the directions of the maker of the compound as to concentration and temperature and compatible with the type of water in use through each milker unit and through each milkcock." Admit air to the system by raising or lowering the teat-cup assembly in the water or solution, or by some other means such as mechanical venting. For this, the advantage of having hot and cold running water available at each stallcock can be seen readily.

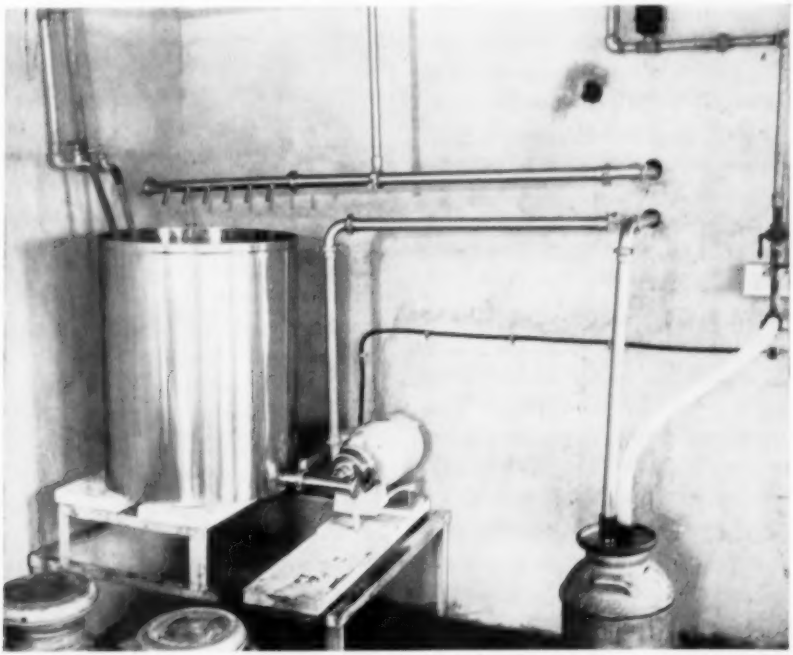


Photo from Tri-Clover Division of the Ladish Co.

Figure 17. A milk house installation for recirculatory cleaning showing solution tank, circulating pump, and manifold for attacking teat-cup units

Sterilization

In all systems, sterilization may be accomplished by either chemicals or heat. If you use halogen compounds, such as chlorine, it is probably advisable to postpone sterilization until just before milking because these solutions should not be left in contact with stainless steel pipe and fittings for extended periods of time. Thus after washing, you may flush the alkaline or acid solution from the pipe with hot water and then delay sterilization until just before milking. Then recirculate or reverse flush a 200 p.p.m. chlorine solution or its equivalent through the pipe for approximately 5 minutes. Remove this and rinse the line with hot water to make sure that no chemicals are mixed with the milk.

For chemcial sterilization of flush-washed systems, never draw less than 20 quarts of a chemical solution of 200 p.p.m. chlorine or the equivalent through each milker unit and each milkcock.

Hot-water sterilization is probably little used on dairy farms because of the quantity of water needed. When properly applied, however, it is extremely effective. Hot water should be circulated for a minimum of 5 minutes, and the temperature should not drop below 180°F. at any point in the system.

General requirements

Always keep the outside surfaces of milking units clean by the washing methods customarily used for standard milking machines.

Always keep the nozzles of milkcocks clean by brushing both inside and out after each use and protect them against dirt while the milk hoses are not connected.

Brush clean all parts of the system that cannot be reached effectively by the flowing rinses or cleaning solutions with at least daily disassembly. This includes dead ends of greater length and one and one-half times the diameter of the pipe, can fillers, inline filters, sanitary pumps, rubber-sleeve connectors, and all other parts not in direct line of flow.

Always wash the air release jar, separator jars, weighing jars, or similar devices according to the directions of the manufacturer of the system.

Clean separately milker units attached to recirculating or reverse flow systems and not reached by the same quantity of flowing solutions as the pipelines.

Care for and store teat-cup units the same as already described (page 7).

Bulk-cooling Tanks

BULK-cooling tanks are constructed of stainless steel. All corners are carefully rounded to facilitate cleaning and all surfaces are visible from the outside of the tank when the covers are raised. Bulk tanks are actually more easily kept in a clean and sanitary condition than are milk cans. Nevertheless,

they must be cleaned carefully after each use to prevent milk materials from drying on their surfaces and building up resultant milkstone deposits.

Special cleaning brushes are essential for each tank. Keep them near the tank, maintain them in good condition, and replace them when necessary.

The steps in cleaning a bulk tank are the same as those for cleaning any other piece of dairy equipment. As soon as the tank has been emptied, the truck driver should rinse it with cold or preferably lukewarm water. This water must be under pressure and supplied through a hose equipped with a self-closing nozzle. This rinse should strike all milk-contact surfaces and the covers and bridge as well. A thorough job of rinsing is perhaps the most important step in the cleaning procedure, because it should remove nearly all milk residues.

Washing

Washing of the tank should follow the rinsing as soon as possible. Remove the agitator and all other demountable fittings, such as thermometers and strainers. Then brush the inside surfaces of the tank and the covers with a solution of a good dairy cleaner made in accordance with the manufacturer's directions and applied preferably at a temperature of 110° to 120°F. Brush all the removable parts, including the outlet valve plug, in the same solution. Following the brushing, rinse and reassemble the equipment. Have the rinse water at the same temperature as the wash water if possible.

Sanitizing

Sanitize the tank just before it is to be used. Spray or brush all milk-contact surfaces with a 200 p.p.m. chlorine solution. Following sanitizing, drain the tank completely. The drained solution may be used to sanitize other dairy equipment.

It is important that chlorine solutions should not remain in contact with stainless steel surfaces for longer than 15 minutes or corrosion may result.

Never use metal sponges to clean stainless-steel equipment. If milkstone forms on any of the milk-contact surfaces, remove it by washing periodically with an acid cleaner solution made and applied in accordance with the manufacturer's instructions. Some operators use an acid cleaner once each week as a precautionary measure.

Preparation and Properties of Sanitizing Compounds

Composition of washing powders

General washing powders formerly consisted of one or two basic components, namely, soda ash and trisodium phosphate. These ingredients, though useful in certain regards, had definite limitations such as poor rinsing and wetting properties.

Modern washing powders have

been greatly improved. The general hand-washing powder now may contain four or five basic ingredients (table 1). Each has a specific task to perform. A good washing powder should soften water, effectively remove fat and protein, and minimize injury to hands. Soap and washing powder are not the same. Never use soap to wash milking machines or dairy equipment, for it leaves greasy films. For the sanitation of milking machines, use washing powders that contain about 4 to 6 per cent of a wetting agent. Many suds produced when you add the washing powder to the water indicate the presence of a wetting agent.

In washing dairy equipment, irritation to hands is sometimes a problem. Red, chapped, or sore hands or an itching or painful sensation around the hands or arms may be a sign that some ingredient in the washing powder or sanitizer-detergent is acting as an irritant. A change to another washing powder without this irritating characteristic is recommended.

Table 1. The average composition of a good, general, hand-washing powder

Ingredient	Percentage concentration	Main function
	Per cent	
Soda ash	30	Cheap source of alkali buffer
Sodium metasilicate	29	Protects hands and equipment; easy-rinsing emulsifier
Complex phosphates	35	Easy-rinsing emulsifier; prevents scale deposits
Wetting agent	6	Reduces surface tension; allows rapid wetting of surfaces

Characteristics of sterilizing solutions

Each of the common dairy sterilizers has certain advantages and limitations. At present there is no known perfect sterilizer.

Lye

Lye solution is sodium hydroxide in a dilute form. It is effective because of its high alkalinity, pH 13. Most bacteria are killed quickly in its presence. Only a few types of bacteria can survive and only in small numbers in milking machines. Lye solutions are effective in another way because of their high alkalinity. They dissolve the protein embedded in the rubber and remove fat as well. These materials ordinarily protect bacteria. With their removal this protection is no longer available and the bacteria are easily killed. This is not true of other sterilizers.

Lye is not influenced by low temperatures. At temperatures around 40°F., lye kills bacteria as effectively as at 75°F. Quaternary ammonium compounds, for example, are weakened at low temperatures. As a general rule, lye sterilization of rubber

A

C

B

D

Figure 18. Making up lye solution for use in lye racks

A. Mix 13 ounces of lye powder and 1 gallon water in crock with care.

B. Pour 8.5 per cent stock solution into a gallon jug.

C. Measure ¾ cup of stock lye solution into gallon jug.

D. Add water to make 1 gallon

parts is one of the cheapest and most reliable of methods.

Among the disadvantages of lye is that it corrodes some metals, especially aluminum, and is caustic to the skin and clothes. The claw on the milking machine is an exception, as it is made up of metal which will withstand lye. Lye is not favored in some areas because it freezes during extremely cold weather. This can be remedied by keeping the racks or crocks in a warm room or cabinet.

Lye for Use on Rack[5]

To make a 0.4 to 0.5 per cent lye solution, it is necessary first to make 1 gallon of concentrated stock solu-

[5] *Milking Machines — Washing and Care.* By H. J. Brueckner and H. S. Pringle. Cornell Extension Bulletin 519. 1942. (Out of print.)

tion (figure 18). Dissolve, carefully, stirring with a wooden stick, one 13-ounce can of lye in a gallon earthenware crock containing cold water. Empty this into a gallon jug and add enough more water to make 1 gallon. This is the stock solution of 8.5 per cent lye. The solution used for the daily sterilization of the teat-cup assembly in the rack is made from the stock solution. Take ¼ cup or 6 ounces of stock solution and add it to another gallon glass jug. Fill to the gallon mark with cold water, cap with a rubber stopper, and mix by inverting several times. This is a 0.4 to 0.5 per cent lye solution. It can be placed directly on the lye rack for sterilizing the tea-cup assembly.

Chlorine

In proper concentration, chlorine is effective against bacteria found in milking machines. It kills very quickly. Preparation of most chlorine solutions is simpler than with lye. Chlorine is not injurious to metals for a brief exposure time or to human skin.

The effectiveness of chlorine is limited by a number of factors. Sunlight weakens chlorine solutions quickly. Brueckner and Pringle[6] state that many chlorine solutions kept in clear-glass bottles lose all or nearly all their chlorine in 7 days. Chlorine solutions must always be stored in brown bottles. Chlorine softens rubber parts if held in continuous contact with them and discolors and pits stainless steel. Chlorine tends to lose its effectiveness in the presence of organic material such as milk.

Preparation of chlorine solutions

For sterilizing milking machines and other dairy equipment, you may use chlorine solutions either as the inorganic compound of chlorine represented by calcium or sodium hypochlorite or in the organic form as chloramine T. The inorganic form is quicker acting, requiring about 30 to 60 seconds to kill bacteria, whereas the organic form kills in about 2 minutes. The strength of the organic form of chlorine is maintained longer, however. The choice depends upon their use. For spraying or rinsing equipment, the faster-acting chlorine compound is desirable; for storing equipment in the solution, the slower acting compound is more useful. For rinsing metal equipment, use 100 p.p.m. available chlorine solution; for teat-cup storage in racks and for wiping cows' udders, use 200 p.p.m.

Much of the chlorine used today on dairy farms comes as a water-soluble powder. Solutions are easy to prepare, and it is advisable to follow the manufacturer's directions on the bottle. The one exception to this is the preparation of chloride of lime or calcium hypochlorite solution. Formerly this solution was quite popular as it could be prepared on the farm rather cheaply

[6] Brueckner, H. J., and Pringle, H. S. *Milking Machines—Washing and Care.* Cornell Extension Bulletin 519. 1942. (Out of print.)

from bleaching powder. Chloride of lime is not used so frequently now for three reasons: (1) it takes more labor and time to prepare; (2) because of the instability of the calcium hypochlorite, the concentration of available chlorine may vary unless the concentration of the final chlorine solution has been tested; (3) the calcium from this compound may form insoluble compounds during washing, tending to increase milkstone.

Detergent sanitizers

(quaternary ammonium compounds plus high alkali plus complex alcohol)

The advantage of using detergent-sanitizers is that they combine the washing and sterilization steps, thus saving time.[7] In the proper concentration and against most bacteria, they are effective. Their high alkalinity helps to remove protein and fat but not so effectively as does lye. They are easy to apply; light does not weaken them; and in normal concentrations they are not usually injurious to metals, rubbers, or clothes.

Detergent-sanitizers can be purchased in liquid or powder form. The usually recommended concentration of 200 p.p.m. is made by dissolving the necessary quantity in water. These compounds have limitations, however. They are relatively expensive and in some instances, especially against the water bacteria (Pseudomonas), they may be selective and not kill so effectively. At temperatures around 50°F. they lose some of their effectiveness. A few brands may be slightly irritating to the hands. If mixed with soap or a number of other chemicals, they lose their sterilizing powers.

Hot water

Rubber or metal equipment exposed to 180°F. water for 5 minutes is effectively sterilized. Hot water once had a deteriorating effect upon rubber but, because the quality of rubber has improved considerably, this is no longer a major consideration. Hot water brightens metal. If hot water at 180°F. or higher is insured, sterilization is effective, simple, and relatively inexpensive.

The limitation with hot water is that it may not be hot enough. This can encourage the growth of thermoduric bacteria. Always use a thermometer to check the temperature. In recent years electric hot water heaters have been designed to produce extremely hot water (figure 12). The initial cost of such equipment is higher than for other methods of sterilization. Hot water at 180°F. is scalding and can cause serious burns if splashed on the skin.

Sterilizing racks or crocks[8]

Wet storage also can be accomplished by using an earthenware

[7] *The Sanitizing of Milking Machines.* By A. C. Dahlberg, F. V. Kosikowsky, H. W. Seeley, and A. A. Leventhal. Jour. Milk and Food Tech. Vol. 13. No. 1. 1950.

[8] *Milking Machines — Washing and Care.* By H. J. Brueckner and H. S. Pringle. Cornell Extension Bulletin 519. 1942. (Out of print.)

crock instead of lye racks. Some areas of the country forbid the use of crocks. In others, particularly the Midwest, the crock is being used to advantage on many farms. Crocks if cleaned frequently, and if the solution is changed regularly, should serve the same purpose as lye racks and are not so expensive. Yet, the many instances where crocks have not been cleaned properly and solutions have become weak have led to the discontinuation of their use. One other difficulty with crocks is that the teat-cup assembly may be placed in it so as to cause air pockets to be trapped in the rubber tubing. Air pockets prevent the sterilizing solution from contacting that portion of the rubber. Parts not in contact with sterilizing solution will not be sterilized. If you place rubber tubes in crocks, leave one end of the tube exposed to the air until most of the tube is under the level of the solution. This prevents air entrapment.

One-step sanitizing with detergent-sanitizers [9]

A new labor-saving method of sanitizing milking machines has been reported by investigators at Cornell. This method utilizes the new detergent-sanitizer compounds now on the market and replaces the individual washing powder and chemical sterilizers, such as lye or chlorine.

[9] *The Sanitizing of Milking Machines.* By A. C. Dahlberg, F. V. Kosikowsky, H. W. Seeley, and A. A. Leventhal. Jour. Milk and Food Tech. Vol. 13, No. 1, 1950.

Figure 19. Soaking the machine for at least 30 minutes in detergent–sanitizer solution

Note how the teat cups are connected together to seal off air openings in the inflations.

Though only recently out of the experimental and testing stage, it appears to show promise when used according to directions. Before adopting the method, check with health authorities to note whether its use complies with their regulations.

Directions

After Morning Milking. Rinse and wash the milking machine with a brush as stated for the standard procedure (page 3), but replace the washing powder with a good detergent-sanitizer powder (1 ounce for each 2 gallons of water). This solution is designed for a one-step treatment and serves as both a washing and a sterilizing agent.

After sucking hot detergent-sanitizer solution through the machine with brushing, disassemble its major parts. Place all parts of the milking machine, including teat-cup assembly sufficiently broken down for adequate brushing, in the first sink

compartment (figure 19). Do not place the pulsator in the sink. The sink compartment contains hot (135°) detergent-sanitizer solution (5 ounces of powder to 10 gallons water). Let the machine parts and all miscellaneous equipment soak fully submerged for at least 30 minutes. After this period, brush all parts well. Remove all parts; reassemble teat-cup assembly and hang it up to dry. Place the metal parts on an open rack to dry. Do not rinse off detergent-sanitizer solution on any parts, rubber or metal, until just before the next milking.

After Evening Milking. Repeat the washing procedure as for after-morning milking with a detergent-sanitizer solution.

General Information

Importance of quick rinsing after milking

Use cold or lukewarm water in this first rinse after milking. Lukewarm water is preferable because it removes the milkfat more readily. The temperature of lukewarm water is about 100°F., just comfortable to the touch. Water warmer than this is not recommended during this first rinsing as its effect on the milk proteins makes it difficult to remove them from surfaces.

The first rinse just after milking is one of the most important acts in sanitizing milking machines. Delay at this point, even for 10 or 15 minutes duration, allows the milk to dry on as a film or layer. Rinsing does little good on dried milk. Eventually, milkstone develops from these dried layers, unless extra care is taken during washing.

Checking the effectiveness of daily cleaning

About once a week it is well to check on the quality of the washing and sterilizing methods used. Just before milking, take a rubber inflation or the milk hose, and bringing it close to the nostril, smell the interior portion. A rancid or any offensive odor indicates improperly cleaned and sterilized equipment.

The sense of sight can be even more useful. When inspecting dairy equipment, it is well to do so when the metal and rubber parts are dry. Most surfaces when wet look clean. Detach the milk hose or a teat cup from a machine. Hold it up to your eye and sight into the light (figure 20). A clean rubber liner is perfectly smooth on the inside, whereas one with accumulations shows a blotchy

Figure 20. Looking through the milk tube to observe how well it was cleaned

type of surface, full of light and dark areas. Take a long metal burr and run it through the rubber milk hose. Pick up a teat cup and run your finger under the lip. If there is an accumulation of gray-white to yellow material either hard or slimy on the burr or on your finger, the equipment needs more cleaning. Look at the inside of your milk pail in the light, especially under the shoulders of the pail or at the corners. Grayish irregular areas indicate milkstone formation.

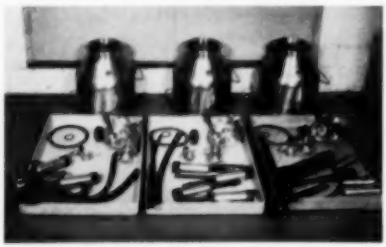


Figure 21. Partial and complete disassembly of milking machines

Some farmers partially disassemble their milking machines each day; others completely disassemble their machines once each week.

Some Precautions in Milking-Machine Sanitation

Old rubbers and tubing

Milking machines are made up of metal and rubber and sometimes plastic. Because rubber surfaces exhibit different characteristics than metal surfaces, they need more attention in cleaning and sterilizing. Metal surfaces are hard and smooth. Rubber surfaces, though smooth when new, may become soft and exhibit some porosity upon use. Bacteria are protected to a certain extent from sterilizers in these pores. During the milking, the pulsating movement of the rubber may force these protected bacteria into the milk supply. Old rubbers are more porous than new rubbers and therefore retain more bacteria. This is an excellent reason why rubber liners or tubes which become too soft and cracked after long usage should be replaced by new ones.

Treating rubber parts to insure long life

At least once a week take the milking machine completely apart and thoroughly clean it. This includes removing all rubber liners from the teat cups and all tubing (figure 21). One of the greatest destroyers of rubber is butterfat. Boiling the rubber parts in lye removes this fat as well as other accumulations in and on the rubber.

After thoroughly cleaning, brushing, and rinsing all parts of the machine, examine the rubber parts for cracks, breaks, and general wear. Renew all badly worn rubber tubing and liners. Place in an enameled dishpan or stainless steel pail all the rubber parts of the machine that have been used for a week. Include replacements. Carefully cover these with a 2 per cent lye solution[10] and

[10] *How to Make Sure Your Milking Machine is Really Clean.* By Evert Wallenfeldt. Univ. Wisc. Circular 378. 1948.

Figure 22. Rubber inflations and tubing in boiling lye solution

with an electric hot plate (figure 22) or stove, bring the solution to a boil. Boil the rubber parts for 15 minutes and then turn off the heater and allow the water to cool. Remove all tubing, and store the inflations in this lye solution until "breakdown" day of the following week. Rinse in clean water the inflations that have been in lye for a week and use them on the milking machine for the current week.

Using two sets of rubber inflations alternately each week is a better practice than using the same set of inflations week after week until worn out. The life of the rubber is considerably lengthened by the use of alternate sets. It has been estimated that two sets of rubber inflations used alternately last as long as three sets used continuously.

Slippage of rubber tubing from claw or head

Sometimes during milking one segment of the rubber line may come apart from the claw or head of the machine. This causes a delay in milking and is irritating. Slippage can be accounted for in a number of ways. The rubbers may be worn out and too loose. New rubber tubing helps. In a number of instances this trouble has been traced to the sterilizing compounds. Lye solutions and quaternary ammonium compounds if used in concentration greater than recommended may be the cause. It is well to see that solutions are made up to proper strengths and rinsed off thoroughly before milking.

Cleaning vacuum lines

Over a period of time, the vacuum line may collect considerable dirt and possibly some milk. Clean this line at least three times a year.

From a 2 per cent lye[11] solution, draw through the vacuum line enough to clean a section. Start suction from the stallcock nearest the vacuum pump and, as that portion is cleaned, move down the vacuum line using alternate stallcocks (figure 23). The purpose of starting nearest to the vacuum pump is to clean the small segments of the pipe at one time. If cleaning is started at the other end of a dirty line, accumulations of dirt large enough to clog the line may form. Flush out all remaining lye solution by sucking through the line a quantity of clean

[11] *Lye for Preserving Rubber and Cleaning Vacuum Lines.* For boiling rubbers and for cleaning vacuum lines, a 2 per cent lye solution is desirable. Use 1 quart of concentrated stock lye solution and make up to 1 gallon with cold water.

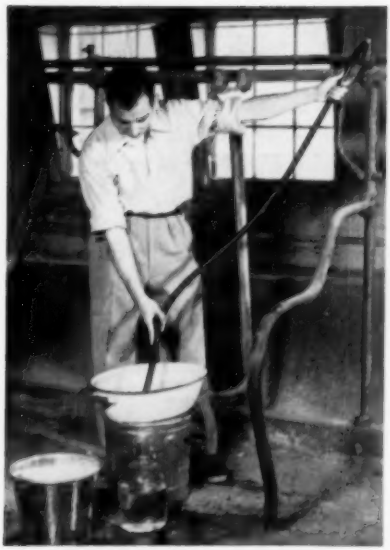


Figure 23. Cleaning out a vacuum line with 2 per cent lye solution

Note clean washing-powder water in pail ready to follow as a rinse. Clear hot water can also be used.

hot water (135°F.). Make certain during the flushing with lye solution and hot water that the moisture trap between the vacuum pump and the first stallcock does not become overfilled.

Occasionally during milking one of the milking-machine pails containing milk may tip over or be overfilled. A portion of this milk may be sucked into the vacuum line. Clean out the line immediately by sucking cold water through the stallcock at least one removed, if possible, below that where the milk was spilled.

Precaution: If the vacuum line is aluminum, do not use lye. Wallenfeldt[12] suggests using a good acid cleaner instead of lye on aluminum vacuum lines.

[12] *How to Make Sure Your Milking Machine Is Really Clean.* By Evert Wallenfeldt. Univ. Wisconsin, Circ. 378. 1948.

August 1955

A publication of the
New York State College of Agriculture,
a unit of the State University of New York,
at Cornell University

Published by the New York State College of Agriculture at Cornell University, Ithaca, New York. M. C. Bond, Director of Extension. This bulletin is published and distributed in furtherance of the purposes provided for in the Acts of Congress of May 8 and June 30, 1914.